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ABSTRACT

Microcomputer versions of three commonly used cognitive style measurement instruments are described and demonstrated: the Leveling-Sharpening House Test (LSHT) (Santostefano, 1964); Lowenfeld's Successive Impressions Test I (SIT-I) (1945); and the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Ruskin, and Karp, 1971). At present, many cognitive style instruments are susceptible to a variety of errors, must be individually administered, or are otherwise logistically uneconomical; e.g., LSHT is individually administered and requires that the hand-held pictures be displayed for five seconds each; SIT-I employs a film presentation that requires the subject to respond relatively quickly in order to match the film's presentation pace; and GEFT uses a 32-page booklet for each subject tested. Microcomputers are dependable, precise, and economical. The graphic capabilities of many microcomputers are perhaps their most valuable asset in the delivery of cognitive style diagnostic and research tools. While some tests, such as the LSHT, may still need a trained observer, others such as the GEFT and SIT-I do not need close supervision with the microcomputer version. All three maintain or increase test reliability. These factors and the ease of gathering data should help encourage further research in the use of cognitive styles for the individualization of instruction. (LMM)

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# Testing and Measurement Potentials of Microcomputers for Cognitive Style Research and Individualized Instruction

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# Testing and Measurement Potentials of Microcomputers for Cognitive Style Research and Individualized Instruction

At present, many of the instruments used to measure an individual's cognitive style are susceptible to a variety of potential errors, must be individually administered, or are otherwise logistically uneconomical. For example, The Leveling-Sharpening House Test (Santostefano, 1964) is individually administered and requires that the hand-held pictures be displayed for five seconds each. Lowenfeld's Successive Impressions Test I (1945) employs a film presentation that requires the subject to respond within a relatively short period of time in order to keep up with the film's pace of presentation. The Group Embedded Figures Test (Witkin, Oltman, Ruskin, and Karp, 1971) uses a 32-page booklet for each subject tested.

Over the past seven and one half years, microprocessors have become increasingly available within our schools, and will become even more widespread in years to come. With this growth in microcomputer use and the increasing emphasis on individualization of instruction, the need for student diagnostic tools that are dependable, reliable, precise, and efficient will also grow.

Microcomputers are dependable machines. In the five year history of the microcomputer teaching lab at the University of Oklahoma, time lost due to equipment failure has been negligible despite heavy use by inexperienced and accident prone students, staff and faculty.

Microcomputers are precise. When instructed to display a sequence of screens for five seconds each, it will display each screen in the prescribed sequence, at the same viewing angle, and without tremor, for exactly five seconds.

Microcomputers are economical. Once the microcomputer has been purchased and a relatively small amount has been spent for software, the cost of administration of diagnostic tools on an individual basis to an unlimited number of students is limited to the cost of electricity for a low consumption instrument, and an occasional two dollar reusable floppy disk for data storage. Many tests can be scored by that same microcomputer. Yet another consideration is that microcomputer programs can be developed in a way that requires virtually no prior experience with either the computer or with typewriter keyboards. The user responses can be gathered with the press of a single key (sometimes any key). Peripherals such as game paddles or joy sticks allow cursor control and response to onscreen prompts with the spin of a knob or the push of a button. Light pens, graphic tablets, touch screens and the 'mouse' all simplify user input.

The graphic capabilities of many microcomputers are perhaps the asset that most enhances their value in the delivery of

cognitive style diagnostic and research tools. Being able to display pictures in high or low resolution in either color or black and white, these microcomputers can replicate the test stimuli that are used in many of the commonly used tests. These same graphic capabilities may also be used to display text font sets for diffent languages and in various sized to accommodate the young and those with visual handicaps.

The remainder of this presentation will describe and demonstrate microcomputer versions of three commonly used tests: The Group Embedded Figures Test for Field Dependence-Independence (Witkin et al, 1971), The Leveling-Sharpening House Test for the Leveling-Sharpening cognitive control principle (Santostefano, 1978), and The Successive Perceptions Test I for the Visual-Haptic perceptual styles (United States Army Air Corps, 1944).

## The Group Embedded Figures Test

The Group Embedded Test (GEFT) was derived from The Embedded Figures Test (EFT) (Witken, 1950) to facilitate group testing. In each of the 18 test figures taken from the EFT, one of eight simple figures is incorporated into increasingly complex figures so the extensions of the lines composing the simple figure make up elements of the complex figure. (See Figure 1). Therefore, the simple figure tends to blend with, or is embedded within, the surrounding visual field. Disembedding the simple figure from the complex field is a task that the field independent subject should be able to accomplish. Results of GEFT testing have been consistent with those from theEFT, The Rod and Frame Test and The Body Adjustment Test (Witkin, Moore, Goodenough & Cox, 1977).

The EFT used colors to emphasize the large organized field

and obscure the simple figure. The GEFT has accomplished this through light shading of similar areas on each figure.

During administration of the GEFT, the simple figures are printed on the back cover of the booklet while the complex figures are on the right side of each inside page. This is to prevent the individual from seeing the two simultaneously, although they may look from one to the other. This is accomplished with the microcomputer by using graphics pages one and two and allowing the subject to toggle back and forth.

Streibel (1980) reports finding decreased differentiation between the cognitive styles with increasing stimulus size. This imposes a limitation on the size of the monitor screen used for testing. The figures used in the microcomputerized version were developed to the same scale as the paper and pencil version, on an 11" monitor, a very commonly used monitor size.

The GEFT is administered in three sections. Following a sample figure and solution, the subject is given two minutes to complete First section, five minutes for the Second Section, and five minutes for the Third Section. This is duplicated in the microcomputer version.

In the paper and pencil GEFT, the subject traces over the outline of the simple figure. This has been accomplished with the microcomputer version by using a LPS II graphics light pen from Gibson Laboratories, with which the subject can draw a colored outline over the simple figure. This new composite is stored on a floppy disk for later scoring.

## The Leveling-Sharpening House Test

The Leveling-Sharpening House Test (LSHT) was developed by Santostefano (1978) to relieve the tedium and boredom that subjects encountered with the earlier Schematizing Squares Test, and to add the conceptual familiarity for younger children not found in the Leveling-Sharpening Circles Test yet still have adequate complexity for the older child that was not present in the Leveling-Sharpening Wagon Test (Santostefano, 1964). The LSHT is described as being effective with subjects from three years of age through adulthood (Santostefano, 1978).

The LSHT consists of a series of 60 handheld test cards, the first of which shows a black and white line drawing of a house and adjacent landscape (See Figure 2). The cards are shown for five seconds each. On every third card a picture will have some detail omitted until by the 58th card, 19 elements are missing from the original scene. Less conspicuous elements are eliminated in the earlier frames and more conspicuous ones later.

The subject is instructed to study each card and then, when the next card is shown, to stop the examiner if any changes are noted. When directed by the subject to "Stop", the examiner records the subject's response, whether correct, incorrect or imagined.

The examiner begins by raising the deck of cards so that the subject sees the first card. Observing a stopwatch, after five seconds, the first card is laid face down so that the second card is seen. This sequence is followed, pausing to record the subject's responses, until all 60 cards have been shown.

The Leveling-Sharpening cognitive control principle deals with how an individual organizes information images in memory and subsequently relates those images to current information. A person who is a leveler has a global image with which new information is fused, whereas the sharpener differentiates between memories and present information. Therefore, on the LSHT, the sharpener should more quickly and accurately detect the changes in the scene.

The Leveling-Sharpening ratio is determined by changes detected, changes not detected, and how quickly, in number of frames from item deletion, the changes were detected. The greater the number of changes noted and the faster the changes are noted, the lower the L-S ratio will be and therefore the greater the tendency toward sharpening.

The need for manipulating handheld cards, watching a stopwatch and concurrent recording of the subject's responses introduce the possibility of variable precision in administering the LSHT. This potential, as well as having noted a need for an administration technique that eliminates the necessity of having a trained examiner present, led Ragan and Dillingham (1979) to develop a microcomputerized version of the LSHT that in informal trial has shown no apparent difference in adult subject responses.

The microcomputer version of the LSHT is accurate and precise in stimulus detail and in presentation timing. As the standard scenes are presented on 8 x 11 inch cards, accuracy of duplication for the computer requires using full screen graphics

on a 13 inch mcnitor.

To obtain the desired advantage of eliminating the need for a trained examiner to monitor, clarify and record responses, the subject may type their responses on the keyboard. The computer will then tag the entry with the frame number and store it on disc for later interpretation. This raises the question of whether or not a typed response will retain the spontaneity and form that is obtained from an oral report. Also, when present during the testing, the examiner may clarify any unclear responses before interpretation.

An associated and probably greater drawback is that even if keyboard entry is shown to be no significant detriment, this will probably hold most true for the relatively skilled typist with at least moderate written communications skills. The hunt-and-peck typist, and those with poor writing skills, will likely become distracted and frustrated, reducing the validity of data gathered. It is also difficult to imagine many three to five year olds being able to effectively enter information this way.

The microcomputer version of the LSHT was developed to be used by adult subjects. For those who have difficulty with keyboard response entry, the test would retain the value of its stimulus presentation attributes by having a trained observer present for data gathering.

## The Successive Impressions Test

As described by Lowenfeld (1945), The Test For Integration of Successive Impressions requires the subject to integrate a series of partial impressions into a whole. This ability belongs to a person of the visual perceptual style, rather than the

haptic who's perception is primarily through the kinesthetic and tactile modalities.

The Successive Impressions Test I (SPT-I) is a version of Lowenfeld's test presented on film for group administration. The SPT-I is composed of three practice and thirty five test items. The subject is presented a blank screen with a narrow window that moves from the top to the bottom of the screen in one second, successively revealing parts of a line drawing. The subject is instructed to attempt to visualize the parts as a whole figure. Then the subject is shown a screen with the intact figure and four similar drawings, and is instructed to choose the correct figure. (See Figure 3). The subject then records his/her selection on a paper score sheet.

The score is the number of correct responses. Ragan, et al. (1979) summarize the research in this typology and report a distribution of 50% visualizers, 25% haptics, and 35% indeterminates. This converts to scores on the SPT-I of 18-35 correct visual, 0-9 correct haptic, and 10-17 correct indeterminate.

A modification of the SPT-I for microcomputer delivery has been done by Edu-Ware Services, Inc. (copyright 1979), under the title Perception II. This version allows the user to determine the number of verticies of the target drawing and the degree of variation between the target and the incorrect figures on the matching screen. Perception II reports the number of correct responses and a score based on the difficulty of the items used. This program is not described by the author as a cognitive style test.

The author is presently developing a version that will replicate the SPT-I. Lowenfeld (1945) gives no indication of object size or duration of exposure of the successive images. Given the variation in projected image size based on distance, apparently size is not important. The version under development will retain the one second exposure time used in the film version. Scoring will be done by the program.

## Conclusion

Microcomputers seem to be capable of administering many of the commonly used cognitive style measurement instruments. They are dependable and can increase reliability through increased precision and accuracy. It is economical to use microcomputers for test administration. While some tests, such as The Leveling-Sharpening House Test may still need a trained observer, many others such as The Group Embedded Figures Test and The Successive Impressions Test I relieve the need for close supervision. All three maintain or increase test reliability. These factors and the ease of gathering data should help encourage further research in the use of cognitive styles for the individualization of instruction. They will surely assist in the delivery of that instruction.

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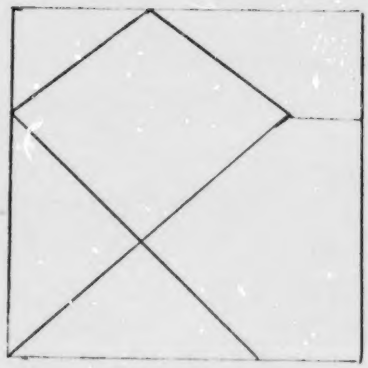
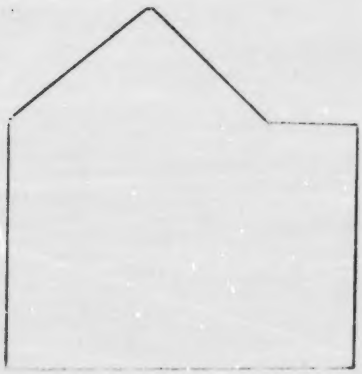
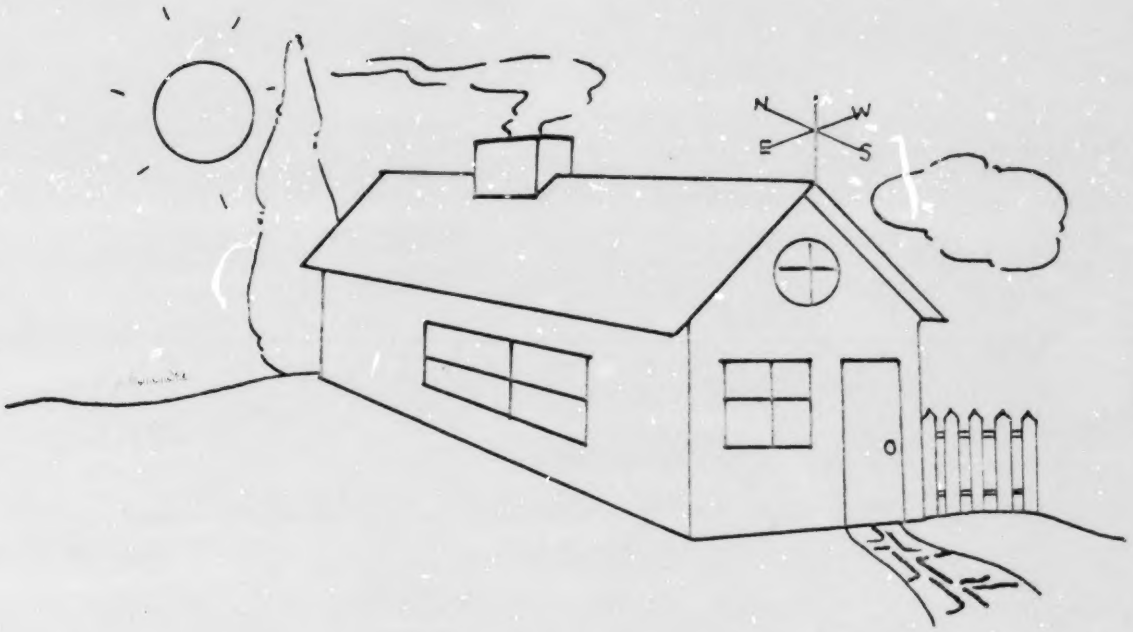


Complex Figure



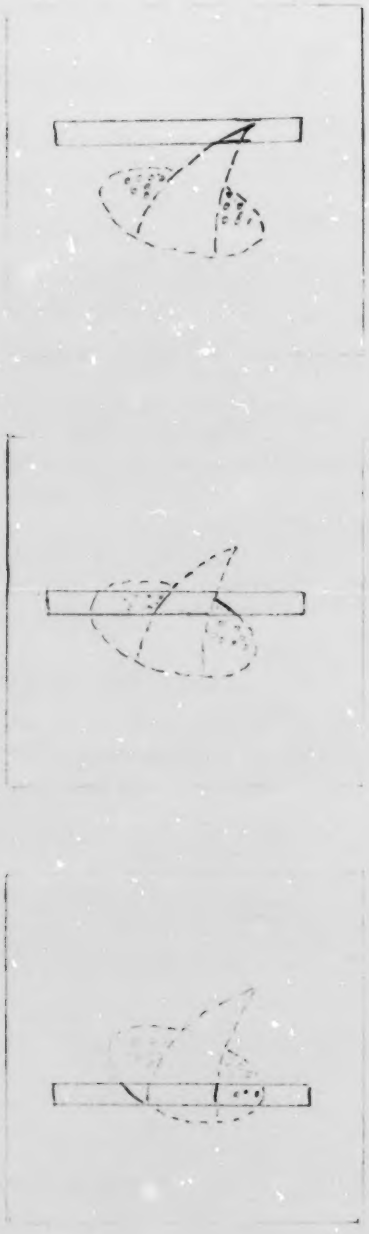
Simple Figure

Group Embedded Figures Test
Figure 1




Leveling-Sharpening House Test

Figure 2



Successive Perceptions Test-I
Figure 3